

Guideline

Biosafety Manual and Emergency Response Plan for Level 2 Permits

Scope and Purpose

This document is a guideline on how to create your lab's permit-specific biosafety manual, it does not constitute your manual.

This guideline is based on the biosafety standards developed by the Public Health Agency of Canada (PHAC) and the Canadian Food Inspection Agency (CFIA) as presented in the *Canadian Biosafety Standard (CBS)*, 2nd edition, 2015 and the *Canadian Biosafety Handbook (CBH)* 2nd edition, 2015. The goal is to provide guidance on how to mitigate the risks of working with risk group 2 (RG2) biological materials. Your permit-specific manual must be developed, implemented, kept up to date and made available to all personnel.

The CBS (*Canadian Biosafety Standard*) can be referenced here (include this link in your manual): <http://canadianbiosafetystandards.collaboration.gc.ca/cbs-ncb/index-eng.php#a4>

The CBH (*Canadian Biosafety Handbook*) can be referenced here (include this link in your manual): <http://canadianbiosafetystandards.collaboration.gc.ca/cbh-gcb/index-eng.php>

More information can be found on the University of Toronto's Biosafety webpage (include this link in your manual): <http://ehs.utoronto.ca/our-services/biosafety/>

Introduction

All biosafety permit holders are responsible for the development of their permit-specific Biosafety Manual which contains institutional policies and programs, a training program, an emergency response plan as well as work-specific Standard Operating Procedures (SOPs). The permit-specific biosafety manual will act as an effective tool with which to educate personnel on hazards, risks, mitigation strategies, emergency response and safe work practices and which personnel can consult as the need arises to review updates or refresh their memories.

Your manual must contain:

1. The University of Toronto's Institutional Biosafety Manual

2. Training program which includes the required Environmental Health & Safety (EHS) courses, in-house training requirements, annual emergency response reviews, training needs assessment procedures, and documentation requirements.
3. Medical surveillance program (if appropriate)
4. Biosecurity plan that includes physical security, accountability for pathogens, toxins and other regulated material (i.e. no release to the environment, requirements for acquiring new biologicals, biological inventories), incident reporting, and information management and security (if appropriate).
5. Housekeeping program which includes routine cleaning/decontamination of laboratory, storage of laboratory supplies.
6. Facility and equipment maintenance program for equipment/components of the containment zone (lab) and integrity testing of primary containment devices used (i.e. Biological Safety Cabinets (BSCs), glove boxes).
7. Standard Operating Procedures (SOPs) for laboratory procedures including safe work practices specific to the containment zone.
8. Emergency Response Plan (ERP) that is detailed and specific to the bioagents/materials/chemicals used in your containment zones, the lab procedures/processes carried out by your personnel and the equipment used.

Your lab's manual should be in digital format. A digital format will allow links to information to be available and make updating the information easier. The information must be organized in a clear manner, and in such a way that your personnel can easily find what they are looking for (i.e. include an index; active links to different sections of your manual).

All lab workers must be familiar with the information contained in your manual and have it available for review. If the manual is in digital format, place the file in a shared directory or instruct all lab workers to have it bookmarked on their computer while associated with the lab. They must be able to reference the manual in a quick and easy fashion.

If planning to use cloud-based storage for your documents, it is recommended that Canadian servers be used.

SOPs should be reviewed and amended whenever there are changes to equipment or procedures. Personnel need to be advised of any changed or updated SOP.

Components of Level 2 Biosafety Manuals (CBS 4.1.10)

1. University of Toronto's Biosafety Policies and Procedures Manual

<https://ehs.utoronto.ca/our-services/biosafety/biosafety-manual/>

This link to the University of Toronto's institutional manual must be included in your lab's manual. It contains information on many biosafety issues such as:

- Biosafety program at UofT
- Relevant physical operation and design of the containment zones and systems
- Medical surveillance program
- Correct use and operation of some laboratory equipment, including primary containment devices
- Incident reporting and follow-up

2. Training Program CBS 4.3, CBH Chapter 8

Your biosafety manual should state your training program objectives and goals and clearly identify the desired behaviour or skill to be learned in training. Training on the contents of your Biosafety Manual and SOPs will familiarize your personnel with the requirements for work in your lab such as biosecurity (i.e. inventory documentation, records management) and your emergency response plan. With training your personnel will be able to safely handle the pathogens and toxins they will encounter in the workplace and respond accordingly in an emergency situation.

Online Environmental Health & Safety (EHS) Training

Before working with any biologicals, personnel must first take the required Environmental Health & Safety (EHS) courses. To determine which courses need to be taken, see the training matrix for laboratory personnel (list of available online courses) which can be found here:

<https://ehs.utoronto.ca/training/laboratory-personnel/>

Training requirements for all personnel working with biologicals:

- **EHS 601 Laboratory Biosafety**: all personnel attached to a biosafety permit must complete this course prior to starting work in the laboratory.
- **EHS 602 Biosafety Refresher**: must be taken annually starting one year after completing EHS 601.
- **EHS 101 WHMIS and Lab Safety**: all personnel attached to a biosafety permit must complete this course prior to starting work in the laboratory.
- **EHS 112 WHMIS Refresher**: must be taken every 3 years after completing EHS 101.

Training requirements for Permit Holders:

- **EHS 601 Laboratory Biosafety**: please note that EHS 601 and the no longer available EHS 014 (PI online biosafety quiz) are equivalent and if you have taken EHS 014 in the past you do not have to take EHS 601.
- **EHS 621 PI Biosafety Refresher**: must be taken annually starting one year after completing EHS 601.

- EHS 101 WHMIS and Lab Safety.
- EHS 112 WHMIS Refresher: must be taken every 3 years after completing EHS 101.

Examples of other training available (for full list see training matrix):

- EHS 603 Bloodborne Pathogens: all personnel that work with primary human tissues/cells/fluids must take this course prior to starting work with these biological agents.
- EHS 532: Respiratory Protection: all personnel requiring a respirator must take this course. It includes an on-line course and an in-person fit test every 2 years.
- EHS 113 Compressed Gas Safety for Lab Users: labs that use compressed gas can have their personnel take this course in tandem with their lab's in-house training. This course will not be tracked by EHS (will not show up on their EHS training record) but a certificate is available to personnel that complete the course.

Any personnel that have not fully completed all required training (trainees) must be directly supervised by trained personnel when working in the lab until they have completed their training (CBS 4.3.8).

If anyone has any questions regarding EHS training, they can check our Training FAQ page at: <https://ehs.utoronto.ca/training-faq/> or contact our course coordinator at ehs.courses@utoronto.ca

Personnel may check their EHS training history by logging into the EHS portal here:

<https://ehs.utoronto.ca/training/my-ehs-training/>

In-House Lab-Specific Training

Personnel must know and understand the potential hazards of their work, and follow all operational practices and procedures. The fundamentals of safe biological work are discussed in the Laboratory Biosafety course (EHS601). Supervisors must also ensure that all personnel, have successfully completed in-house training on their lab's SOPs including equipment use, waste procedures and emergency response. Personnel must show understanding and competence in those procedures prior to working in the lab. This requirement is applicable to both new and experienced personnel. All in-house training must be documented, dated and signed by both the trainee and trainer, and available for review upon request by EHS personnel and external regulators. Documentation of all in-house training should be kept by the supervisor for a minimum of 5 years after the personnel has left the lab.

In-house training must include the following:

- Relevant components of the permit-specific Biosafety Manual and SOPs as determined by a training needs assessment (CBS 4.3.1)
- Potential hazards associated with the work involved, including the signs and symptoms of disease(s) caused by the infectious material or toxins in use and the necessary precautions to prevent exposure to, or release of, pathogens or toxins (CBS 4.3.2). This should include safe work practices and physical control measures such as decontamination and waste management,

and the correct use of PPE. Information on relevant safety information e. g. Pathogen Safety Data Sheets (PSDSs) and how to find and use these materials should be provided

- Relevant (to their activities) physical design and operation of the containment zone and containment systems (CBS 4.3.3) and on the correct use and operation of laboratory equipment (CBS 4.3.4). This should include how to determine if the equipment is functioning properly and how to protect against a release or exposure. A review of any secondary containment systems should also be included. Some examples of equipment and systems are Biological Safety Cabinets (BSCs), autoclaves, primary containment caging systems, centrifuges, incubators, fume hoods and any other laboratory equipment/apparatus used when handling biologicals or toxins
- Personnel working with animals to be trained in restraint and handling techniques (CBS 4.3.5)

Training Needs Assessments

Training needs assessments should be undertaken by supervisors on a regular basis at minimum annually, or more often if there is a change in program intent, new research protocols/practices or following any incidents that may have occurred in the lab (CBS 4.3.9, 4.10.1) to determine if all personnel are up to date on their required in-house and EHS training. Retraining or training reviews may have to be undertaken when SOPs are amended with changes to equipment, projects or procedures, remember to also update your emergency response plan when changes are made. Any in-house retraining must also be documented.

Annual In-House Emergency Response Review

Level 2 permits must have an annual in-house emergency response review and your personnel's attendance must be documented. Your ERP review should include (but is not limited to) spill procedures, ocular exposure, spill on body, needle puncture, BSC alarm, evacuation, fire, location of spill kits and safety equipment (showers, eyewashes, fire extinguishers, first aid) emergency contact #s, incident reporting procedures, etc. Documentation of these reviews must be available for review upon request by EHS personnel and external regulators (CBS 4.3.10).

Biosafety Memorandum of Understanding and Agreement (MOU)

It is the permit holder's responsibility to have on file signed MOU forms for everyone listed on their permit. These forms must be kept for at least 5 years from the last date of the personnel's appointment and in perpetuity if work with lentivirus is undertaken. The MOU file must be available for review upon request by EHS personnel. The biosafety MOU can be found here:

<https://ehs.utoronto.ca/wp-content/uploads/2016/10/Memorandum-of-Agreement.pdf>

3. Medical Surveillance Program CBS 4.2 (if appropriate)

Participation in the University of Toronto's medical surveillance program is usually required for personnel working with human fluids, tissues and primary cells. This program provides health surveillance, testing and immunization with relevant, licensed vaccines for university employees and students. These personnel must also take the Bloodborne Pathogens course, EHS 603.

For information about the university's medical surveillance program your staff/students should contact the Occupational Health Nurse at ehs.occhealth@utoronto.ca.

Further information on our medical surveillance program can be found at: <https://ehs.utoronto.ca/our-services/occupational-health/>

And on in the University of Toronto Institutional Biosafety Manual: <https://ehs.utoronto.ca/our-services/biosafety/biosafety-manual/medical-surveillance-immunoprophylaxis/>

4. Biosecurity CBS 4.1.11, CBH Chapter 6

Lab Access/Security CBS 4.5.2

No unauthorized personnel are to have access to the lab (authorized means attached to your permit and fully trained). Visitors must be accompanied at all times. All Risk Group 2 (RG2) biologicals must be kept in spill-proof, impact-resistant containers, secure (behind a lock) and labelled (door signage or storage sign).

Containment (lab) doors must be kept shut (4.5.1 CBS). Any unoccupied labs must be locked. Unlocked and unoccupied labs are considered a serious biosecurity concern. Not only is there a possibility of biological agents or hazardous chemicals being removed from the lab but personal items and lab equipment could be stolen.

No Release of Biologicals from Facilities

A Local Risk Assessment (LRA) should be performed to assess what procedures/training is required to ensure that no viable biologicals will be released into the environment from your facilities (labs). These risk assessments must also consider the containment of any genetic material (i.e. eggs, pollen, spores etc.) from genetically modified or non-native species. This may take the form of having additional equipment in your spill kit (i.e. spill containment dikes or drain closures) to block any biological spills from going down floor drains; moving equipment containing larger volumes (i.e. shakers) away from drains; regularly checking process equipment for leaks; correct labelling/dating of waste containers; additional physical containment requirements (i.e. screens or secondary containment) and additional training of personnel.

Inventory of RG2 Biologicals CBS 4.10.2; CBH Chapter 19

Labs must have an inventory of the RG2 biologicals that are in their possession for 30 days or longer. The inventory must include what you have (i.e.name/description/identifier), state the biological's risk

group and location (i.e. room #, storage unit). It is recommended that information necessary to track material i.e. disposal of samples; transfers; inactivation, should be included so that samples are not deemed missing or lost. If any RG2 biologicals are considered missing or presumed stolen the permit holder must notify the biosafety office.

Inventory information may be accessed in response to an emergency situation where samples need to be relocated (e.g., power outage) or in response to requests from PHAC or the CFIA (e.g., targeted request for specific pathogens). Inventories can exist in many different forms. The specific format (e.g. electronic or paper inventory, a list, a logbook of samples) for establishing and maintaining inventories must be determined by the permit holder on a containment zone level. Include a written SOP on when and how your inventory needs to be updated.

Permit holders working with Security Sensitive Bio Agents (SSBAs) e.g. Cholera toxin, need to keep a logbook detailing the usage of these agents. The SSBA list: <https://www.canada.ca/en/public-health/services/laboratory-biosafety-biosecurity/human-pathogens-toxins-act/security-sensitive-biological-agents.html>

If any of your biological agents required a CFIA import permit, then more information for these agents is required, including: Dates of importation; dates of any transfers; import permit/transfer approval permits; conditions placed on import/transfer; when and where material is used; dates of disposal/complete transfer/inactivation.

Any records for imported animal pathogens must be kept for a minimum of 2 years after final disposal, transfer or inactivation of the imported material (CBS 4.10.10).

See Chapter 19 in the Canadian Biosafety Handbook (CBH) for detailed instructions:

<https://www.canada.ca/en/public-health/services/canadian-biosafety-standards-guidelines/handbook-second-edition/chapter-16-20.html#ch19>

5. Housekeeping, Laboratory Storage

Housekeeping is the responsibility of laboratory personnel and/or other specifically trained staff.

The containment zone (including floors) must be kept clean, free from obstructions, and free from materials that are in excess, not required, or that cannot be easily decontaminated (4.6.35 CBS).

A clean, uncluttered work environment allows appropriate decontamination of the containment zone. It also minimizes slipping, tripping, fall, and collision hazards that could potentially lead to exposure incidents or the spread of contamination. Storing excess materials outside the containment zone also protects this material from becoming contaminated.

Do not store any items that are difficult to decontaminate on or near the floor i.e. cardboard or Styrofoam, place these items up off the floor or in plastic storage containers. Glass bottles should not be stored on the floor where they are a dangerous trip hazard. If they must be stored on the floor, then place them in secondary containment (i.e. a pail or other plastic container).

If using bench coat/bench protector paper, regular change-outs should occur as part of housekeeping and if spills occur. The covering of work surfaces with bench coat must not interfere with the required decontamination procedures. Work surfaces where biologicals are handled must be decontaminated when work is finished for the day or more often based on your lab's local risk assessment (LRA). (CBS 4.6.11)

Housekeeping should also include items like ensuring liquid hand soap and paper towels are always available at your hand washing sink, and waterproof bandages and other First Aid supplies are checked and replaced when needed.

Do not have electric power bars or other electrical connections on the floor in labs. Having electrical connections on the floor may lead to possible electrical hazards or damage to sensitive equipment if a flood or spill were to occur.

6. Facility and Equipment Maintenance

Lab equipment also requires regular cleaning, decontamination and other maintenance. Your lab's housekeeping schedule/plan should also contain equipment maintenance i.e. cleaning and lubrication of centrifuge rotor/bucket seals, vacuum in-line filter change-outs etc. The lab's maintenance program should also include any testing/validation of primary containment devices. As with the operation of any equipment, the manufacturer's instructions on safe use and required maintenance should be followed.

Equipment Maintenance Schedules (a few examples)

- Vacuum Line Systems: have a maintenance schedule that includes filter replacement and vacuum line trap maintenance in your biosafety manual
- Centrifuges: A maintenance plan is required that ensures that you are evaluating the integrity of both the buckets and O-rings (where applicable) and that this is documented
- Electronic Pipette filters: ensure that the filters in these pipettes is the correct size and that you regularly change them out. Documentation of change-outs should be kept
- Weekly flushing of emergency eyewashes must be done in all labs and this flushing needs to be documented. See the UofT Safety Eyewash and Shower Standard for further information and testing advice: <https://ehs.utoronto.ca/wp-content/uploads/2015/10/Emergency-Eyewash-and-Shower-Std.pdf>
- Biological Safety Cabinets (BSCs) and other equipment that have come into contact with biological material must be decontaminated prior to service or certification by authorized personnel and before removal from labs or disposal (CBS 4.8.8)

BSC Certification/Documentation

Biological safety cabinets must be certified upon initial installation, annually and after any repairs, modifications or relocation. (4.6.15 CBS)

Verify that the BSC certification documentation (both the certification report and BSC sticker) identifies the serial # of the BSC in question correctly each time your BSC is certified.

Your BSC(s) certification documentation must be in your possession and available for viewing by both internal (i.e. EHS) and external (i.e. Ministry of Labour, PHAC, CFIA) inspectors. Certification documentation must be kept by permit holders for a minimum of 5 years.

Visual inspections of work area (lab) CBS 5.1.2

In-house lab inspections must be conducted on a regular basis at minimum annually (once per term or every 4 months is recommended), and corrective actions are to be taken if any damage, faults or deterioration (e.g. chipped benchtops, faulty equipment and lighting) is found. Records of all inspections and corrective actions are to be kept for at least 5 years.

If working with large volumes (10L or more) all process equipment, closed systems and containment devices to be inspected for leaks on a regular basis.

A general lab checklist can be downloaded here, add items for checking that are consistent with your work and permit requirements:

<https://ehs.utoronto.ca/wp-content/uploads/2016/12/Laboratory-PI-inspection-checklist-Oct-2016-ver-1.02.pd-Updated.pdf>

7. Standard Operating Procedures (SOPs) for Safe Work Practices

The safe work practices required in your lab should be based on the hazards that have been identified by your lab's LRAs. These safe work practices would include any safety precautions deemed necessary by the biosafety permit holder and should include written instructions concerning, e.g. extra PPE (i.e. eye protection) requirements, aerosol reduction, sharps use, risks associated with work, how to use lab equipment etc. These practices provide a foundation for the development of your lab's work-specific, safety-focused SOPs.

Local Risk Assessments (LRAs) CBS 4.1.8, CBH 4.4.1

Permit holders/Principal Investigators are responsible for their site-specific LRAs. These assessments should identify hazards based on the pathogen, infectious material, or toxin in use and the activities to be performed in their laboratories. They should identify not only the potential biological hazards but any other hazards such as chemical, radiological, or physical risks and outline measures to be used to reduce the risk of injury. This risk assessment can then be used to create their work-specific, safety-focused SOPs.

For more details on LRAs see CBH 4.4.1 and Canadian Biosafety Guideline – Local Risk Assessment:

<https://www.canada.ca/en/public-health/services/canadian-biosafety-standards-guidelines/guidance/canadian-biosafety-guidelines.html>

Standard Operating Procedures (SOP) CBS 4.1.15, CBH 5.3.5

A Standard Operating Procedure (SOP) is a detailed step-by-step procedural document on how to safely perform the activities and procedures done in your lab. It should contain precise, practical instructions on how to use instruments, handle bioagents, perform experiments and all the safety measures that should be followed including PPE requirements. It should also include maintenance and documentation requirements, waste and decontamination instructions, emergency procedures and accident reporting instructions.

Principal Investigators are responsible for reviewing and approving all SOPs relevant to their laboratory operations. SOPs should be introduced to personnel during training and must be reviewed, understood and followed by all laboratory users. The SOPs should be included in your lab-specific biosafety manual and be available for review by all users. SOPs should be reviewed and amended whenever there are changes to equipment or procedures. Personnel need to be advised of any changed or updated SOP.

For more information on SOPs see CBH 5.3.5

SOPs should contain the following (if applicable) and any other instructions needed to perform lab activities safely, based on your LRA:

- safety considerations/potential hazards/risks based on risk assessment, any special handling procedures
- PPE requirements
- entry/exit procedures
- use of primary containment devices
- instructions on where the work is to be carried out, e.g. BSC, fume hood
- animal work considerations
- decontamination, cleaning procedures and waste (disposal) procedures for both liquid and solid waste
- safe and secure movement/transportation of infectious materials or toxins and storage requirements
- any procedure/task involving infectious material, toxins, and/or infected animals, as determined by an LRA
- spills, accident procedures and exposure response (must be included in your emergency response plan)

Information to Assist in the Writing of SOPs

Included below is some general information and reference links to assist labs in the creation of their work-specific SOPs.

Safe Work Practices Documents

See the biosafety webpage <https://ehs.utoronto.ca/our-services/biosafety/> for available “Safe Work Practices” documents, for example:

Safe Work Practices - Safe Sharps Use:

<https://ehs.utoronto.ca/wp-content/uploads/2020/09/Safe-Work-Practices-Safe-Sharps-Use.pdf>

Safe Work Practices – Centrifuge Use:

<https://ehs.utoronto.ca/wp-content/uploads/2020/10/Safe-Work-Practices-Centrifuge-Use.pdf>

Personal Protective Equipment (PPE) CBS 4.4, CBH Chapter 9

The PPE to be worn when working in any lab should be in accordance with the highest risk or possible hazard for the equipment, biological agents, material or chemical used in the procedure. The supervisor must advise personnel on what PPE is required based on a LRA to identify potential risks in any lab procedure.

PPE must be worn at all times when working with biological agents and stored within the containment zone (lab) (CBS 4.4.1). Check the Safety Data Sheet(s) (SDSs) for the chemicals that will be used in the procedure, to ascertain if any additional PPE is required.

- Lab coats must be long sleeved and knee length (CBS 4.4.1)
- Long pants or skirt (the entirety of the legs must be covered)
- Shoes are to be closed toe and heel, low heeled (or no heeled) and have non slip soles (CBS 4.6.3)
- Gloves (CBS 4.4.4). Specific glove types may have to be specified for different procedures (based on you LRA). Some examples include, nitrile/latex laboratory gloves for handling specimens, and insulated utility gloves for handling freezing materials. Ensure gloves are compatible with possible hazards
- Safety goggles and/or face shield if there is a possibility of ocular splash, or flying debris (CBS 4.4.2)
- Respirators may be required due to potential exposure to aerosols outside of a primary containment device based on your LRA. Those personnel that must wear respirators must be fit tested every 2 years, see: <https://ehs.utoronto.ca/training/respiratory-protection-training-fit-testing/>
- Personnel to remove PPE carefully to minimize possible contamination of their skin, hair or clothing when leaving the containment zone (lab) (CBS 4.5.14)
- Potentially contaminated clothing articles and PPE should be decontaminated prior to washing (CBS 4.8.5, 4.8.6): <https://ehs.utoronto.ca/wp-content/uploads/2015/10/Lab-Coat-Washing-Guidelines.pdf>

Additional information and resources on PPE are provided below:

University of Toronto Environmental Health and Safety

General Laboratory PPE Assessment tool: <https://ehs.utoronto.ca/wp-content/uploads/2016/06/Laboratory-PPE-Assessment-Tool.pd-Updated.pdf>

General information on PPE: <https://ehs.utoronto.ca/resources/personal-protective-equipment-ppe/>

Lab coat Guidelines: <https://ehs.utoronto.ca/wp-content/uploads/2017/04/Lab-Coat-Guidelines.pdf>

Protective Glove Standard: <https://ehs.utoronto.ca/wp-content/uploads/2015/10/Hand-Protection-Gloves.pdf>

Protective Eye and Face wear Standard: <https://ehs.utoronto.ca/wp-content/uploads/2015/10/Eye-Protection-Standard.pdf>

Respiratory Protection Program: <https://ehs.utoronto.ca/wp-content/uploads/2015/10/Respiratory-Protection-Program.pdf>

Waterproof Dressings

Any breach of the skin (scratch, cut, wound) needs to be protected from contact with infectious material or toxins. Waterproof dressings (waterproof adhesive bandages) must be available to people working with biologicals (4.6.6 CBS). The type that seal all around the circumference are recommended.

Instructions on the requirement to cover cuts or scrapes on hands with waterproof dressings before work with biological agents should be included in the relevant SOPs as part of the PPE section of your permit-specific biosafety manual.

Hand Washing

Must be done after removing gloves, before leaving the lab, after working with animals, toxins, chemicals or biologicals. Ensure that liquid hand soap and paper towels are always available at the hand washing sink in your lab (include in your lab maintenance schedule).

Decontamination Procedures CBH Chapter 15

Your manual must detail the decontamination procedures followed in your lab i.e. what disinfectant should be used and at what final concentration for all biologicals handled; required disinfectant contact time to be indicated; describe what equipment needs to be disinfected and how often; work areas are to be disinfected after each experiment or at the end of the day. If your lab uses a BSC, it must be disinfected for certification personnel.

Pathogen Safety Data Sheets (PSDS) for your RG2 biologicals are an excellent source of information on appropriate and effective disinfectants as well as other important information.

Some quick facts about Bleach:

- Active ingredient is sodium hypochlorite.

- Bleach stocks come in a variety of different concentrations of sodium hypochlorite, from as low as 3% up to 12% for some industry brands.
- Lab members MUST know the concentration in their stock to be able to calculate the final dilution of sodium hypochlorite. For example, if your bleach stock is 6% then 100 ml. of bleach stock can be added to 500 ml. of fluid to result in 600 ml. of 1% sodium hypochlorite (dilution often used for spills). Lab SOPs should state the final dilution of sodium hypochlorite required for disinfection NOT the % of bleach (since bleach stocks are so variable).
- Diluted bleach breaks down very quickly and must be remade fresh every 24 hours.
- Bleach is very corrosive, if using 0.5% or higher of sodium hypochlorite to disinfect surfaces then be sure to rinse them with water after the required contact time (usually 20 – 30 minutes depending on organism).
- Bleach must never be autoclaved as this can cause chlorine gas to be released.

Waste Management Protocols CBH Chapter 16

Include in-house procedures for the pre-treatment of RG1, the handling of RG2 waste (solid and liquid) and procedures for toxin disposal. All RG1 biologicals (solid and liquid waste) must be pre-treated (made non-viable) before disposal in the regular garbage stream. All RG2 biologicals are to be disposed of as biohazardous waste. If you have any questions regarding waste, contact the Environmental Protection Services (EPS) at 416-946-3473/416-978-7000. See the Hazardous Waste Manual for further contact information.

For a summary of waste procedures to be followed in bio labs:

https://ehs.utoronto.ca/wp-content/uploads/2019/04/Waste-Information-and-Procedures-for-Bio-Labs_v3.1-09-14-2020.pdf

Include the link for the university's hazardous waste manual:

<http://ehs.utoronto.ca/laboratory-hazardous-waste-management-and-disposal-manual/>

Movement of Biological Material CBH Chapter 20

For movement within the containment zone (lab), ensure that all precautions are taken to avoid spills and the release of biologicals. The precautions taken to prevent mishaps should correspond to the inherent risk associated with the bioagent being moved. In other words, greater care should be taken with bioagents with higher inherent risk (CBH 2.1.1). Bioagents should be moved in closed containers (primary containment) which are leak-proof and impact-resistant. Screw top containers should be used rather than snap-cap tubes.

For movement outside of the containment zone (lab) but still within the same building, ensure that all biologicals are secured in labelled, closed and leak-proof secondary containers. The surfaces of all transportation containers must be decontaminated prior to use (CBS 4.8.8). Movement of biologicals out of the containment zone must only be done when transporting to a decontamination area, another

appropriate containment zone or storage area (CBS 4.6.19,4.8.8). Use a cart with raised edges and guard rails when moving heavy containers or a large number of samples (CBH 2.1.2). Avoid using passenger elevators, where possible use freight elevators instead.

For movement between buildings, if transporting RG2 biologicals across any public road (for example across College Street) then Transportation of Dangerous Goods (TDG) regulations apply to carriers and packagers, they must both be TDG certified. The container the biologicals are in must also meet TDG requirements.

8. Emergency Response Plan (ERP) CBS 4.1.16, 4.9.1, CBH Chapter 17

An Emergency Response Plan based on overarching risk assessments and LRAs must be developed, implemented and kept up to date. It must be available to all personnel.

Your ERP must include the name and telephone number of emergency contacts and describe emergency procedures in the work area for the following:

Accidents/incidents

An incident is an event with the potential to cause injury, harm, or damage. Incidents include accidents, as well as near misses and other dangerous occurrences. The term "incident" refers to all possible occurrences, including accidents, exposures (that may cause disease), laboratory acquired infections/intoxications (LAIs), containment failures, environmental releases (e.g., improperly treated waste or spills sent to the sewer system), and biosecurity breaches (e.g., theft or intentional misuse of an infectious material or toxin).

All incidents involving pathogens, toxins, other regulated infectious material, infected animals or involving failure of containment/control systems or release to the environment to be reported immediately to your Principal Investigator and the Senior Biosafety Officer.

For a more detailed explanation and examples see CBH Chapter 18.

Incident investigation will be conducted and documented in order to determine the cause(s). Records of any incidents involving pathogens, toxins, and other regulated infectious material, infected animals, or loss of containment must be kept on file for a minimum of 10 years.

Medical Emergencies

Call 911 or campus police and inform them if biologicals are involved.

Personnel must immediately inform their supervisor of any accident causing injury. Within 24 hours, the supervisor will have to file a report via the University of Toronto EHS website (<https://ehs.utoronto.ca/report-an-incident/>). Appropriate medical evaluation, surveillance, and treatment must be sought and provided if needed.

Medical emergency contacts: <https://ehs.utoronto.ca/report-an-incident/emergency-procedures/medical-emergencyfirst-aid/>

Fire

For UofT fire prevention information including laboratory fire safety and fire emergency procedures:

<https://ehs.utoronto.ca/report-an-incident/emergency-procedures/fire/>

<http://www.fs.utoronto.ca/main-property-management/fire-prevention/>

<http://www.fs.utoronto.ca/main-property-management/fire-prevention/lab/>

Emergency Egress/Evacuation

Ensure that lab personnel are familiar with at least 2 routes out of your building for the purpose of emergency evacuation. Remind them that when the fire alarm sounds, they must leave the building.

Post emergency evacuation instructions at the exits from your lab. The following basic lab evacuation may be modified by the permit holder:

Basic Emergency Lab evacuation:

Always assume you may not be able to return to the lab for some time.

1. Turn off any direct sources of heat (i.e. Bunsen burners, hot plates, ovens, water baths)
2. Close any open containers of biologicals and chemicals.
3. Remove any PPE and take your personal belongings (including any outerwear i.e. winter coat).
4. Leave the building – Shut the lab door behind you. Ensure the lab door is locked.

People should wash their hands or use hand sanitizer (if effective against biologicals in use) before leaving the lab, but this depends on the severity of the emergency and what they were working with.

Chemical/Biological spills

Chemical Spills:

Check the information on the chemical's SDS (Safety Data Sheet) for spill procedures/PPE requirements. The SDS for all chemicals in the lab must be available to your personnel. Ensure that all personnel are familiar on how to access this information.

Chemical spill Procedures:

Place a copy in a waterproof sleeve in your Chemical Spill kit and post a copy near your fume hood or area where chemicals are handled.

<https://ehs.utoronto.ca/report-an-incident/emergency-procedures/chemical-spill-procedures/>

University of Toronto Environmental Health and Safety

Chemical Spill Response Training:

For a short online course on how to handle small chemical laboratory spills see the information about EHS 820:

<https://ehs.utoronto.ca/our-services/environmental-protection-services/eps-training-presentations/>

Chemical spills on body (including ocular exposure):

<https://ehs.utoronto.ca/report-an-incident/emergency-procedures/chemical-spills-on-body/>

Mercury Spill Procedures (if applicable):

<https://ehs.utoronto.ca/report-an-incident/emergency-procedures/mercury-spill-procedures/>

Guide for Chemical Spill kits:

These kits can be purchased or assembled, all personnel should be aware of the location of your spill kit.

<https://ehs.utoronto.ca/laboratory-hazardous-waste-management-and-disposal-manual/guide-for-general-laboratory-spill-kit-contents/>

For more information about Chemical and Lab Safety and more spill procedures, please see the following webpage for a list of available SOPs/standards/documents:

<https://ehs.utoronto.ca/our-services/chemical-and-lab-safety/>

If you have any questions about chemical storage/safety, please contact our Chemical and Lab Safety specialist Geoff Shirtliff-Hinds at: geoff.shirtliff.hinds@utoronto.ca

Biological Spills:

Biological Spill General Procedures (ensure that your people know what disinfectant to use and at what final concentration):<http://ehs.utoronto.ca/our-services/biosafety/biological-spills/>

The Canadian Biosafety Handbook has a chapter outlining spill procedures (Chapter 17.3) which can be accessed here: <https://www.canada.ca/en/public-health/services/canadian-biosafety-standards-guidelines/handbook-second-edition/chapter-16-20.html#s173>

Have printed spill procedures available (in a waterproof sleeve) in or near your spill kit and post BSC spill procedures on all biological safety cabinets. Spill procedures specific to your biologicals are required.

If assistance with spills is necessary, contact the Environmental Protection Service (EPS) or contact Campus Police after hours. All spills must be reported to the permit holder.

EPS contact numbers – 416-946-3473/416-978-7000

Biological Spill Kits:

It is a University of Toronto policy that all Level 2 biosafety permits have a biological spill kit available to their personnel. Instructions on what items to have in your spill kit can be accessed here:

<https://ehs.utoronto.ca/our-services/biosafety/biological-spill-kit-2/>

Spill on lab coat: <https://ehs.utoronto.ca/wp-content/uploads/2015/10/Lab-Coat-Washing-Guidelines.pdf>

Power Failure

Include any instructions that are needed in your lab i.e. don't open freezers. For BSCs see instructions under "Failure of Primary Containment Devices" below.

Animal Escape (if applicable)

Animal facilities have procedures and contact information available. If working with animals from these facilities, have this information in your manual. If working with animals that are not from campus animal facilities (e.g. invertebrates), then you will have to write instructions for needed procedures to ensure no inadvertent release into the environment, and provide emergency contacts.

Failure of Primary Containment Devices

BSC Failure/Alarm:

For biological safety cabinets if the power goes off or if the alarm sounds or there are other indications of cabinet malfunction such as no airflow, or unusual noises (post this at all BSCs):

<https://ehs.utoronto.ca/wp-content/uploads/2020/11/BSC-Failure-or-Alarm-Poster.pdf>

If the BSC failure is due to a temporary power failure restart when the power returns. If there is a BSC malfunction have the cabinet serviced by qualified personnel. Ensure the BSC is fully decontaminated before servicing.

Other Primary Containment Devices:

For all other primary containment devices (e.g. isolators, centrifuges with sealable cups, ventilated cage racks, process equipment, micro-isolator cages, and bio hazardous waste containers) have emergency procedures available. Check operator's manuals for information and guidance.

Loss of Containment

If there is a loss of containment, depending on materials involved have emergency procedures available. All loss of containment must be reported to your supervisor. Reports should include the material involved, amount, location and any remedial action taken. Any inadvertent release of biological material from the containment zone must also be reported to the Senior Biosafety Officer.

Emergency Contacts/Notification of Key Personnel

Have a list of emergency contacts posted in your lab (ensure personnel know where this list is located).

For an overview of emergency response preparedness for labs, including emergency contacts at UofT (police, fire, medical, spills etc.): <https://ehs.utoronto.ca/emergency-response-overview-u-t-labs/>

All incidents involving pathogens, toxins, other regulated infectious material, infected animals or involving failure of containment/control systems must be reported immediately to your Principal Investigator.

Natural Disasters

See lab evacuation plan above. Ensure that all RG2 biologicals are kept secure and labelled. Have a plan in place on how your biologicals could be moved if necessary.

Incident Reporting and Follow-up

List appropriate internal authority and contact information. All accidents or near-miss incidents are to be reported to the permit holder.

For incidents involving biologicals, the permit holder may contact the Senior Biosafety Officer, Ayoob Ghalami (ayoob.ghalami@utoronto.ca) for assistance in investigating and for recommendations to mitigate future risk. The permit holder **must** contact the Senior Biosafety Officer without delay if the following incidents occur:

- a). Inadvertent release to the environment of biological material or toxin.
- b). If permit holder has in their possession or Inadvertently produces a biological agent not listed on their permit.
- c). When a biological agent has caused an illness or may have caused an illness in laboratory personnel.
- d). When a biological agent may have been stolen or is otherwise missing.

For incidents involving chemicals or general lab safety, the Chemical & Lab Safety Specialist, Geoff Shirliff-Hinds (geoff.shirliff.hinds@utoronto.ca) can be contacted.

Other information to have in your manual (if applicable)

- Containment and disposal SOPs for genetically modified and non-native organisms (including plants and invertebrates)
- Pathogen Safety Data Sheets (PSDS) if available for your RG2: <http://www.phac-aspc.gc.ca/lab-bio/res/psds-ftss/index-eng.php>
- SDS for any toxins, written SOP for toxin disposal. If working with toxins on the Security Sensitive Biological Agents (SSBA) list, a usage logbook is required, have a written SOP on how and when this log book should be updated. The Security Sensitive Biological Agents list: <https://www.canada.ca/en/public-health/services/laboratory-biosafety-biosecurity/human-pathogens-toxins-act/security-sensitive-biological-agents.html>

- Aerosol reduction techniques: <http://ehs.utoronto.ca/our-services/biosafety/techniques-for-minimizing-aerosols/> and <https://ehs.utoronto.ca/wp-content/uploads/2020/09/Safe-Work-Practices-Aerosol-Risk-Reduction-RG2-Biological-Agents.pdf>
- If working with aquatic animal pathogens, your manual must contain the CFIA's "Containment Standards for Facilities Handling Aquatic Animal Pathogens"
<http://www.inspection.gc.ca/animals/aquatic-animals/imports/pathogens/facilities/eng/1377962925061/1377963021283>
- If working with plant pests, your manual must contain the CFIA's "Containment Standards for Facilities Handling Plant Pests"
<http://www.inspection.gc.ca/plants/plant-pests-invasive-species/biocontainment/containment-standards/eng/1412353866032/1412354048442>
- If any biological agents are received by import permit, all conditions listed on the import permit must be noted and followed i.e. transfers, changes in work may need the government regulators to be notified by the Senior Biosafety Officer

For all additional safety and contact information, please visit our website www.ehs.utoronto.ca